INTRODUCTION TO
THE
POWEREX POOL OPERATION

(PPO)

POWEREX

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(PPO)

PROJECT SPONSOR: Ken Epp, President and CEO, POWEREX

PROJECT LEADERS: Dr. Zak El-Ramly, Vice-President, Development, POWEREX
King Lum, Director, Power Contracts, POWEREX

PROJECT TEAM: Henry Mark, Director, POWEREX Pool Operation, POWEREX
Graeme Simpson, Director, Market Development, POWEREX
Joseph Mui, System Operations, B.C. HYDRO
Frank Power, System Operations, B.C. HYDRO
Ken Spafford, Resource Planning, B.C. HYDRO
Jai Mumick, System Transmission Planning, B.C. Hydro

REPORT WRITTEN BY: Kelly Lail, Policy Development, B.C. HYDRO

May 1990

Dear Readers,

This report describes the principal policies and procedures that will govern the POWEREX Pool Operation. Detailed work on rules and operating prodecures for participation of suppliers and users is in progress and is expected to be completed by 1 July 1990.

The actual implementation has been initiated with substantially full operation expected 1 September 1990.

If you need further information please contact Dr. Zak El-Ramly, Vice-President, Development, at (604) 663-3277 or Mr. King Lum, Director, Power Contracts at (604) 663-4429.

Yours truly,

Dr. Zak El-Ramly
Vice-President, Development

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EXECUTIVE SUMMARY

The POWEREX Pool Operation (PPO) is part of the British Columbia Power Export Corporation (POWEREX). It is a marketing operation that will serve short term bulk electricity markets within and outside of British Columbia, including Alberta and the Western United States. The PPO will facilitate short term electricity transactions to realize competitive opportunities and efficiency gains in the bulk power market for the benefit of British Columbia. Short term transactions are any electricity transactions with a duration of less than one year.

The PPO will utilize the B.C. Hydro electric system and reservoirs to transmit and store electricity for both bulk producers and users. It will use POWEREX's power marketing "know how" to facilitate short term electricity transactions. The PPO will operate as an effective market maker in a deregulated "open access" environment. Its activities will include buying, selling, storing, lending, exchanging and wheeling short term electricity and other related services.

The objectives of the PPO are to maximize the benefits to POWEREX, B.C. Hydro and British Columbia from short term electricity exchanges, create an active short term electricity market, provide expanded access to all electricity trade customers and to enhance the value of surplus electricity from non-utility generators.

The PPO will post hourly, monthly and longer term buy and sell prices and quantities based on market conditions including current bid and ask prices and forecast supply and demand. A supplier will also have the option of responding by nominating a selling price to the PPO. The PPO may require the supplier to base the nominated price on the supplier's incremental production cost. The charge for wheeling of electricity is based on a charge for interutility tie lines and a charge for wheeling within the province on the B.C. Hydro system. The charge for storage, paid at the time of return of stored energy, is based on posted energy buy and sell prices at the times of storage and return. The PPO posted short term capacity prices will be time, region and duration differentiated to reflect the value of capacity.

The PPO will facilitate increased trade in the bulk short term electricity markets by meeting varying degrees of market supply and demand requirements. The value of energy produced by IPPs will be enhanced by the PPO providing storage, backup and shaping. Storage and lending of energy will provide opportunities to capitalize on the best market conditions and provide flexibility to IPPs in their operation by pooling resources to meet the specific needs of producers and users.

Consultants have reviewed the PPO concepts and have advised that, "The PPO and its proposed operation is consistent with the emerging direction towards increased competitiveness in North American power markets. It has unique features such as its unbundled storage and market based pricing mechanisms which are expected to contribute to efficiency in the bulk power markets." The PPO and its proposed pricing structure are expected to significantly increase short term electricity trade. The proposed pricing structure may require modifications for optimum operation and the long term health of the short term electricity market. The PPO will expand the short term electricity market for the benefit of PPO trading partners, POWEREX, B.C. Hydro and the province of British Columbia.

POWEREX POOL OPERATION

1.0 INTRODUCTION

The POWEREX Pool Operation (PPO) is part of the British Columbia Power Export Corporation (POWEREX). It is a marketing operation that will serve the short term bulk electricity markets within and outside of British Columbia including Alberta and the Western United States. The PPO will facilitate short term electricity transactions to realize competitive opportunities and efficiency gains in the open bulk power market for the benefit of British Columbia. Short term transactions are any electricity transactions with a duration of less than one year.

The emergence of non-utility generators and the surplus power generated by co-generation has resulted in increased competition in the generation sector of the utility business. This trend is expected to continue into the future as advances in generation technology continue and more suppliers enter the market. One result of these developments is an increase in the supply and the usage of short term firm and non-firm electricity. At this time there is no effective mechanism for marketing this short term supply; bringing short term suppliers and users together. There are also electric utilities that have surplus short term non-firm electricity that is not being marketed effectively because of the absence of an effective "market maker".

The PPO will operate as an effective market maker in the short term bulk power market in a deregulated, "open-access" environment. It will utilize the unique hydro based generation, storage reservoirs and transmission system of B.C. Hydro to store and transmit electricity for bulk producers. It will use POWEREX's extensive power marketing "know-how" to facilitate short term electricity transactions. The marketing activities will include buying, selling, storing, lending, exchanging and wheeling of short term energy, capacity and other related services.

2.0 PRINCIPLES

The opportunities to serve the short term bulk electricity markets exist due to previous investments by B.C. Hydro and the surplus capability of the B.C. Hydro system. Accordingly, any short term surplus capability which exists on a utility system at one time or another is utilized to provide maximum benefits to B.C. Hydro, which in turn will benefit its customers and the province of British Columbia.

The short term electricity market is an opportunistic market for all players. All suppliers, consumers and market operators are free to participate to maximize their own gains. Accordingly, the pricing of products and services provided by the PPO will

be market driven. The pricing structure will be such that it will promote the long term health of the competitive short term electricity market.

The pricing policies of the PPO will be non-discriminatory. All players requesting the same service will be treated equally. Any deal offered to one player will be offered to any player for the same service. Since the price at which a transaction is consummated in an open market reflects the buyer's and the seller's own perception of the market, any negotiated deal will not be considered discriminatory.

3.0 OBJECTIVES

The following are the objectives of the PPO:

- Maximize return on the use of B.C. Hydro's facilities and POWEREX's "know-how" through short term electricity transactions.
- Create an active short term electricity market to significantly increase the value of electricity trade that exists today.
- Provide short term electricity suppliers and users greater access to the short term power market.
- Expand the existing short term electricity market to include industrial consumers, including B.C. Hydro's native load customers, capable of utilizing short term electricity.
- Provide broader integration of utility and non-utility electric generation to improve the quality of competition in the short term bulk power supply market.
- Encourage economic development in the province.
- Encourage efficiency in generation of electricity.

4.0 PRODUCTS AND SERVICES

The PPO will purchase and sell short term electricity and provide related services to suppliers and users. Short term is defined as a period of a duration less than one year. The PPO will also provide related bundled products or services to meet specific needs of suppliers and users. The PPO will have the right to set supply and service voltage levels, transaction duration, price and minimum and maximum quantities by type of product and/or service, in total and/or by individual transactions. The products and services provided by the Pool will consist of:

- Buying short term energy supplies.
- Selling short term energy on a spot basis.

- Storing energy for producers and consumers.
- Providing short term firm and interruptible wheeling service.
- Lending energy to producers.
- Buying and selling short term capacity.

5.0 PRICING

Prices for all PPO products and services will be market driven. With wheeling available there are sufficient alternatives available to the buyers and sellers to create a workable competitive environment for bulk power exchanges. The PPO will facilitate purchases and sales transactions in a public and competitive market.

A supplier will also have the option of nominating its own selling price to the PPO. The PPO may require the supplier to base the nominated price on the supplier's incremental production cost. The incremental production cost must be supported by sufficient information made available to the PPO. The PPO may accept or reject the supplier's nominated price. The PPO will share the difference between its sell price and the supplier's nominated price equally, after subtracting a charge for system losses and operation and maintenance costs. This is similar to the current utility practice of "splitting the benefits" in pricing of economy energy interchanges.

The PPO will post hourly, monthly and longer term buy and sell prices and quantities. These prices will reflect current responses to buy and sell prices and the PPO's perception of the future market. The terms and pricing of lending energy to producers will be based on current and forecasted future energy prices. The scheduling of transactions will be on the basis of the highest to the lowest gain to the PPO. Transactions that provide the same gains to the PPO will be served on a first come first served basis.

The PPO opportunity gain is defined as the difference between posted buy and sell prices, less a Wheeling Commission (Wc). The Wheeling Commission is defined as the charge for system operations and maintenance costs and losses.

The following sections describe a preliminary pricing structure. It is anticipated that this structure may require modifications, after actual marketing experience, for optimum operation of the PPO and the long term health of the short term electricity market.

5.1 Buy and Sell at PPO Posted Prices

The PPO will buy and sell specified quantities of energy at the posted prices for hourly, monthly and longer periods but less than one year.

The PPO revenue is the posted sell price (Ps). The supplier's revenue is the PPO's posted buy price (Pb). This is illustrated in Figure 5.1-1.

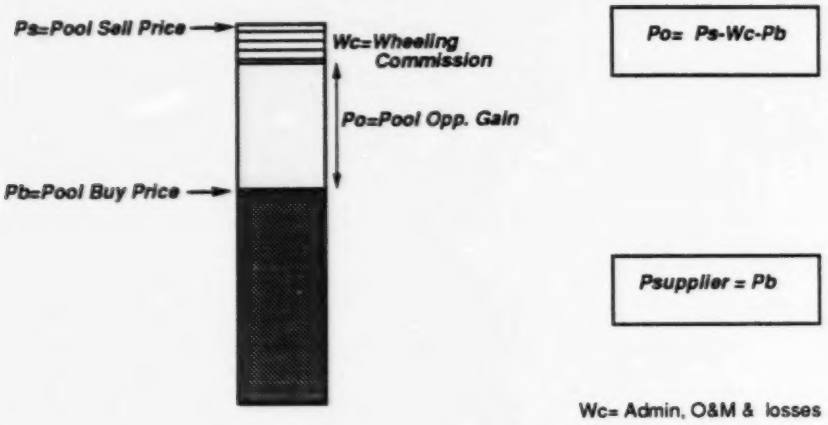


Figure 5.1-1- Buy and Sell at PPO Posted Prices

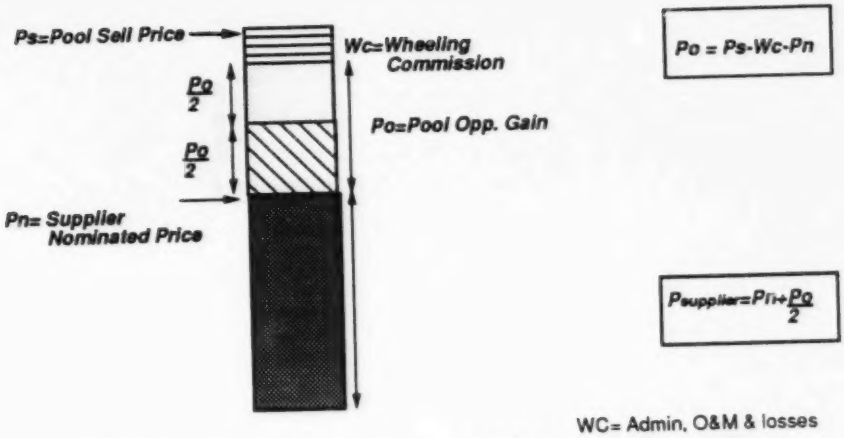
For transactions at posted buy and sell prices the PPO performs the services of wheeling, storage and brokering. The PPO bears the risk associated with finding a market for the energy it purchases. Since the PPO gains title to the short term energy purchased from suppliers, it captures the full gain between its buy and sell prices. This price structure is expected to encourage economic efficiency by providing low-cost generators with a posted buy price for their surplus energy as well as enabling consumers to have access to energy at the market driven sell price.

5.2 Buy at Supplier's Nominated Price and Sell at PPO's Set Price

A supplier may nominate its own sell price to the PPO. In a split the savings type transaction this price must be based on the supplier's own incremental production cost. This cost must be agreed to by the PPO before any transactions take place at the supplier nominated price.

The PPO will schedule sufficient buy transactions up to set quantities needed to meet demand. The transaction scheduling order will be based on the highest to lowest net gain to the PPO. The risk to a supplier nominating its own price to the PPO is that a transaction may not occur at all if the PPO has sufficient lower cost resources to meet the short term market demand.

The difference between the PPO set sell price and the supplier nominated price less Wheeling Commission is shared equally with the supplier. The supplier's revenue is the nominated price plus half of the PPO opportunity gain. This is illustrated in Figure 5.2-1.

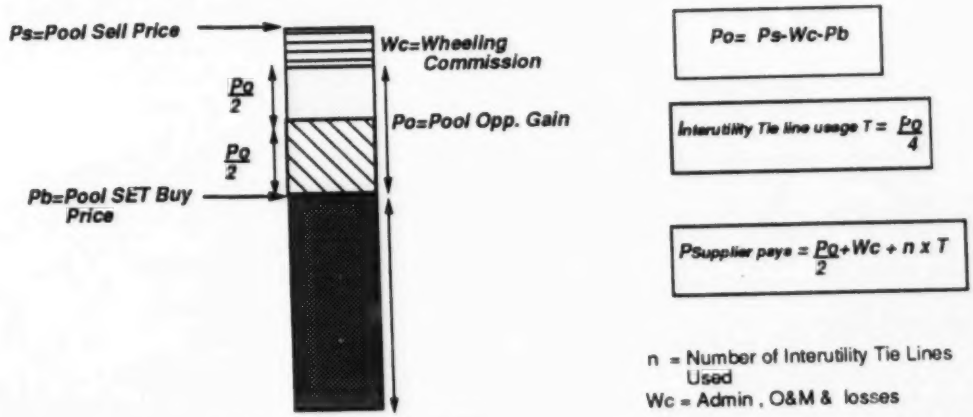


5.2-1- Buy at Supplier Nominated Price and Sell at PPO Posted Price

This option is an important component of PPO pricing; it allows suppliers the ability to capture additional economic trades that may have been foreclosed under the PPO set buy price and provides energy suppliers with an opportunity to exercise their own market edge and pursue additional trades.

5.3 Wheeling Service

The Pool will provide short term wheeling service to allow market players to find their own trading partners. The total wheeling service charge will be based on a charge for wheeling within the province on the B.C. Hydro system, plus a charge for interutility tie lines, plus the Wheeling Commission. The wheeling service charge for wheeling within the province on the B.C. Hydro system will be one half of the PPO opportunity gain. The charge for the use of interutility tie lines will be one quarter of the PPO opportunity gain based on the time of use, for each of the interutility tie lines. This is illustrated in Figure 5.3-1.


Ps=Pool Sell Price
Wc=Wheeling Commission
Po/2
Po=Pool Opp. Gain
Po/2
Pb=Pool SET Buy Price
Po= Ps-Wc-Pb
Interutility Tie line usage T = Po/4
PSupplier pays = Po/2+Wc + n x T
n = Number of Interutility Tie Lines Used
Wc = Admin , O&M & losses

5.3-1 - Wheeling Only

The wheeling service price structure reflects the value of the limited interutility tie lines capacity and the benefits of wheeling within the province. Wheeling transactions within the province do not impact the domestic system loadings significantly since the equivalent capacity will be made available by B.C. Hydro not serving the same load requirements, assuming that the load will have to be served regardless of the supplier. A wheeling transaction through the B.C. Hydro system to serve a load that is outside the B.C. Hydro system, however, creates additional transmission load on the B.C. Hydro system and decreases valuable interutility tie line capacity.

5.4 Energy Storage

The PPO will utilize B.C. Hydro's reservoirs to store short term energy. A storage charge, paid by a supplier at the time of energy return, consists of two components, an entry charge component (Sc_1) and a return charge component (Sc_2). The entry charge component will be one quarter of the PPO opportunity gain (Po_1) at the time energy goes into storage. The return charge component will depend on the end use and location of the returned energy. There will also be an interutility tie line usage charge (T) for each usage of an interutility tie line.

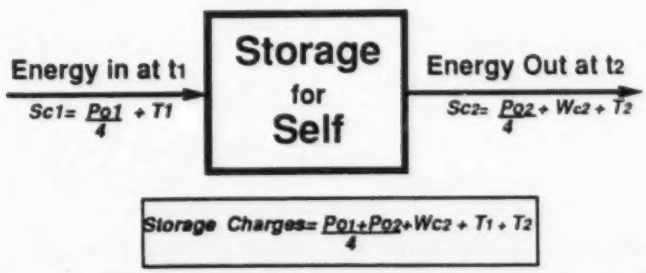
For all storage options the supplier assumes the risk of spilling. All storage is subject to first in first out for return of energy and subject to last in first spill under spill conditions.

5.4.1 Storage for Own Use

Normally, the energy in storage is returned to the originating supplier. The total return charge will be one quarter of the opportunity gain at the time of storage (Po_1), plus one quarter of the PPO opportunity gain at the time of withdrawal from storage (Po_2) plus the Wheeling Commission, plus charges for each interutility tie line usage, if any. Therefore, the total storage charge is

$$\frac{Po_1 + Po_2}{4} + Wc + T_1 + T_2.$$

This is illustrated in figure 5.4-1.

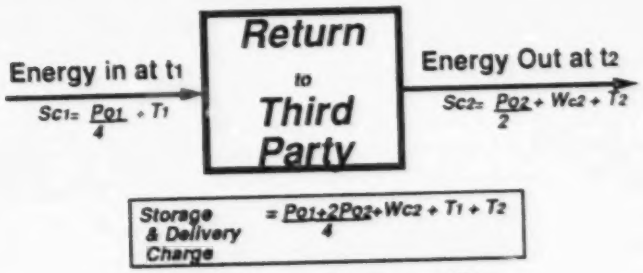


5.4-1 - Return to Supplier

5.4.2 Return Energy Sent to Third Party

The supplier can have the return energy sent directly to a third party by the PPO. In this case, the PPO provides storage and wheeling services. The storage return charge component will be one half the PPO opportunity gain (PO_2), plus the Wheeling Commission plus a charge for each use of an interutility tie line, if the energy return location is outside the B.C. Hydro system. The total charge is: $\frac{Po_1 + 2Po_2}{4} + Wc + T_1 + T_2$.

This is illustrated in Figure 5.4-2.

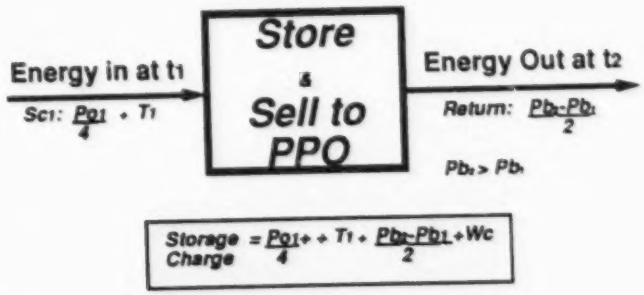

Energy in at t1
Sc1= Po1/4 + T1
Return to Third Party
Energy Out at t2
Sc2= Po2/2 + Wc2 + T2
Storage & Delivery Charge
= Po1+2Po2+Wc2 + T1 + T2
4

5.4 - 2 Return to Someone Else

5.4.3 Return Energy Sold To the PPO

The supplier can sell its stored energy to the PPO at any time. In this case, the return charge component will be half of the difference in the PPO buy price gain from the time of entry, plus the Wheeling Commission. That is, the PPO will share one half of the gain realized by the supplier due to the buy price at time of return being higher than at the time of entry. The total storage fee will be: $\frac{Po_1}{4} + T_1 + \frac{Pb_2 - Pb_1}{2} + Wc$,

where $(Pb_2 - Pb_1) > 0$. This is illustrated in Figure 5.4-3. The revenue to the supplier on return will be based on the option the supplier chooses to sell to the PPO.



5.4 - 3 Return to the PPO

5.5 Short Term Capacity

The PPO will buy and sell short term capacity at posted prices. The posted prices will be time, location and duration differentiated to reflect the value of capacity.

6.0 BENEFITS

The PPO will provide benefits to B.C. Hydro, Non-utility Generators (NUGS), POWEREX, other electric utilities, electricity users and the Province of British Columbia.

6.1 B.C. Hydro

The PPO will increase the utilization of surplus capability of the B.C. Hydro system. This will contribute to efficiency gains and provide an opportunity for B.C. Hydro to earn higher returns on its surplus capability.

The expected increase in trade will enable B.C. Hydro to sell more surplus energy at prices that are competitive. On the other hand, during low stream conditions B.C. Hydro will be able to replenish its energy resources by buying from the PPO. B.C. Hydro will also be able to purchase part of its reserve requirements emergency energy, economy energy and energy to meet its requirements during major plant maintenance.

6.2 Non-Utility Generators

For IPPs, co-generators and other non-utility generators the PPO will provide expanded market access. The PPO is designed to enhance the value of short term energy generated by non-utility generators (NUGS) by providing backup, shaping and storage. Lending and storing will allow NUGS flexibility in their operations. IPPs and co-generators can generate and sell or store during periods of surplus. On the other hand, during periods of deficit, maintenance and emergency, they can buy energy or withdraw stored energy to meet their own requirements.

The PPO will create an active short term market with a greater number of suppliers and users with varying supply and demand characteristics. This will allow better matching of suppliers and users by pooling resources and users.

6.3 POWEREX

The PPO will provide greater exposure of POWEREX in the bulk power market. It will supplement POWEREX's long term power sales obligations by providing short term energy during periods of deficit to satisfy long term contracts. When POWEREX has a short term surplus from its long term supply sources it would be able to sell it through the PPO. This would enhance POWEREX's ability to compete

in the bulk power market and would also attract more IPPs who can exploit both short and long term opportunities.

6.4 Electric Utilities

The PPO provides greater supply and demand options to electric utilities within and outside British Columbia. Utilities with a short term deficit will be able to meet their requirements by buying from the PPO, and utilities who have invested for long term will be able to minimize their costs by selling any short te n surplus to the PPO. These utilities would also be able to purchase part of their reserve requirements, economy energy and energy during maintenance thus reducing their operating costs. These short term supplies and purchases at competitive prices will contribute towards the efficiency of electric utilities in the supply of electricity.

6.5 Electricity Users

The increase in trade and market driven prices will provide increased market information to both suppliers and users. This is expected to increase the degree and quality of competition in the short term electricity market. This competitiveness will allow electricity users to reduce their energy costs by supplementing their utility purchases by buying from the PPO.

6.6 The Province of British Columbia

The PPO will encourage growth in the IPP sector which will encourage provincial resource development. The competition in generation of electricity is expected to encourage economic efficiency in the supply of electricity to users within B.C. This will contribute to provincial revenues and the economic development of the province.

7.0 FURTHER WORK & IMPLE-MENTATION

Further detailed work on rules and operating procedures for participation of suppliers and users, adjustment of current transfer pricing practices between POWEREX and B.C. Hydro where necessary for compensation to B.C. Hydro for the use of its facilities, metering and billing, communications methods and accounting, are all in progress and are expected to be completed by 1 July 1990.

Possible ways B.C. Hydro customers could participate in the PPO are described in Appendix 1. They are provided for discussion only.

Implementation of the PPO has been initiated. Substantially full operation is expected 1 September 1990.

8.0 SUMMARY/ ASSESSMENT

Consultants have reviewed the PPO concepts and advised that, "the PPO and its proposed operation is consistent with emerging directions towards increased competitiveness in North American power markets. It has unique features such as its unbundled storage and market based pricing mechanisms which are expected to contribute to efficiency in the bulk power markets".

OPTIONS FOR PARTICIPATION IN POWEREX POOL OPERATION BY EXISTING BC HYDRO'S TRANSMISSION RATE CUSTOMERS

The PPO can provide an opportunity for Hydro's existing transmission customers to take advantage of market priced electricity. Electricity from the pool would offer customers the opportunity to take advantage of short term sales or inventory stocking, etc. Hydro will require this to be achieved while keeping the other B.C. Hydro core firm customer indifferent or better off. This concept is utilized in the natural gas industry. In B.C. Hydro's situation, the protection for the Core Customers would be achieved through an appropriate planning period.

The following outlines our initial suggestions on possible arrangements which could be offered to customers. The general thrust of these proposed arrangements is to make PPO energy as available as possible while allowing B.C. Hydro to take advantage of the released generation to serve future customers.

Possible electricity supply arrangements:

1. Customer nominates a fixed amount of PPO energy to be delivered each month. The difference between the PPO energy and the customers load would be billed at the 1821 rate. The PPO electricity would be treated as base load with a load factor of 100%.

2. Customer nominates a base load, capacity and energy, from B.C. Hydro and any additional energy and capacity over the base load is from the PPO.

3. Customer nominates a percentage of his load to be served from the PPO. The nomination would include both a capacity and an energy nomination.

4. Customer splits his load and separately meters the electricity supplied by PPO and B.C. Hydro.

General conditions attached to PPO's electricity being made available to existing Transmission Customers:

1. The minimum period a customer could agree to take electricity from the PPO is four years. The minimum notice that B.C. Hydro requires from a customer who wants to return to B.C. Hydro for all his requirements is three years. Three years will give B.C. Hydro enough time to find additional generation to serve the customer's load through additional purchases from IPP's. Other conditions applying to the load being returned to B.C. Hydro for supply will be the same as those applying to any new load applying for service. Since these are existing customers, transmission plans will not be affected by the supply changes.

2. B.C. Hydro will supply a returned customer's electricity requirements when less than three year's notice has been given at its incremental cost. The incremental rate will apply until an equivalent of a three year notice period is completed.

3. Any electricity supplied by B.C. Hydro above the contracted amount, that is not met by the PPO for any reason, will be billed at B.C. Hydro incremental cost.